Notice of Allowability	Application No. 09/955,181	Applicant(s) KATSUTANI, MASAFUMI	
	Examiner Negussie Worku	Art Unit 2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *09/19/01*.
2. ☒ The allowed claim(s) is/are *1-120*.
3. ☒ The drawings filed on *0/19/01* are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 09/19/01
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Negussie Worku
3/23/05

DETAILED ACTION

Reasons for Allowance

1. The following is an examiner's statement of reasons for allowance: With respect to claim 1-15, the prior art dos not teach or disclose an optical scanning system comprising: a light source; and an optical scanner which performs optical scanning of a surface to be scanned by deflecting a luminous flux having a wavelength "lambda" from said light source by means of an optical deflector, and condensing the deflected flux toward the surface to be scanned through a scanning image forming optical system, thereby forming an optical spot on said surface to be scanned, wherein said scanning image forming optical system has at least one lens; and wherein, in the said scanning image forming optical system, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents

a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}].

With respect to claim 16-30 and 56, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system having at least one lens, in which, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}], (1) and causing an optical deflector to deflect a luminous flux having a wavelength .lambda. from a light source, condensing the deflected luminous flux through the scanning image forming

optical system toward a surface to be scanned, and forming an optical spot on said surface to be scanned, thereby conducting optical scanning of said surface to be scanned.

With respect to claim 31-43 and 57 the prior art dos not teach or disclose an optical scanning method comprising the steps of: providing a semiconductor laser as a light source; providing a scanning image forming optical system having at least one lens, in which, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}]; (1) and causing a luminous flux having a wavelength .lambda. from the light source side to enter an optical deflector via a coupling lens, deflecting the luminous flux through said optical deflector, condensing the deflected luminous flux toward a surface to be scanned through the scanning image forming

optical system, and forming an optical spot on the surface to be scanned, thereby conducting optical scanning of the surface to be scanned.

With respect to claim 44-46 and 58 the prior art dos not teach or disclose an optical scanning method comprising the steps of: providing a semiconductor laser as a light source; providing a scanning image forming optical system having at least one lens, in which, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}]; (1) and converting a luminous flux having a wavelength .lambda. from the light source into a parallel luminous flux, then entering an optical deflector via a coupling lens, a function of the coupling lens being a collimating function, deflecting the luminous flux through said optical deflector, condensing the deflected luminous flux toward a surface to be scanned through a scanning image

forming optical system, and forming an optical spot on the surface to be scanned, thereby conducting optical scanning of the surface to be scanned.

With respect to claim 47-52 and 59, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a semiconductor laser as a light source, providing a scanning image forming optical system having at least one lens, in which, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}], (1) said scanning image forming optical system being an anamorphic optical system associating a starting point of deflection by an optical deflector and a surface to be scanned into an opto-geometrical conjugate relationship relative to a sub-scanning direction; coupling a luminous flux having a wavelength .lambda. from the light source with a subsequent optical system through a coupling lens, condensing the coupled

luminous flux in the sub-scanning direction by a line image forming optical system, forming a line image long in the main scanning direction near the deflecting reflective surface position of a rotary mirror serving as the optical deflector, and condensing the deflected luminous flux by the scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, thereby conducting optical scanning of said surface to be scanned.

With respect to claim 53-55 and 60, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a semiconductor laser as a light source, providing a scanning image forming optical system having at least one lens, in which, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square root}(k).times.fm.sup.2/.omega..sup.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}], (1) said scanning image forming optical system being

an anamorphic optical system associating a starting point of deflection by an optical deflector and the surface to be scanned into an opto-geometrical conjugate relationship relative to a sub-scanning direction; converting a luminous flux having a wavelength .lambda. from the light source into a parallel luminous flux, then condensing the parallel flux in the sub-scanning direction through a line image forming optical system to form a line image long in the main scanning direction near a deflecting reflective surface position of a rotary mirror serving as the optical deflector, and condensing the deflected luminous flux by the scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, thereby conducting optical scanning of said surface to be scanned.

With respect to claims 61-75, the prior art dos not teach or disclose 61. A scanning image forming optical system used in an optical scanner performing optical scanning of a surface to be scanned by deflecting a luminous flux having a wavelength .lambda. from a light source, and condensing the deflected luminous flux by the scanning image forming optical system toward the surface to be scanned to form an optical spot on the surface to be scanned, wherein said optical scanner has an aimed spot diameter .omega. for an optical spot formed by the scanning image forming optical system at an optical spot height of 0; wherein said scanning image forming optical system has at least one lens; and wherein when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846

.lambda..times.{square root}(k).times.fn.sup.2/.omega..sup.2}-fm where, fm represents the focal length in the main scanning direction; k represents the number of lens surfaces; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}].

With respect to claims 76-91, the prior art dos not teach or disclose an image forming apparatus, comprising: a photosensitive medium for forming a latent image thereupon through optical scanning of a photosensitive surface thereof; a visualizing device configured to visualize the latent image on the photosensitive medium; and an optical scanner configured to perform optical scanning of the photosensitive surface of the photosensitive medium to form the latent image by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, and condensing the deflected flux toward the photosensitive surface of the photosensitive medium through a scanning image forming optical system, thereby forming an optical spot on said surface to be scanned, wherein said scanning image forming optical system has at least one lens, and wherein, in the said scanning image forming optical system, when a focal length f.sigma. in a main scanning direction at a surface accuracy .sigma.i is defined as: f.sigma.={2.6846 .lambda..times.{square

root}(k).times.fm.sup.2/.omega..s- up.2}-fm where, fm represents a focal length in the main scanning direction of said scanning image forming optical system; k represents the number of lens surfaces; .omega. represents an aimed spot diameter of the optical spot in the main scanning direction at an image height of 0; .sigma.i represents a surface accuracy of an i-th lens surface as counted from an optical deflector side; n represents a refractive index of material of a lens having the i-th lens surface; and 1/L represents a spatial frequency in the main scanning direction on said lens surface; then, said surface accuracy .sigma.i, said focal length f.sigma., said refractive index n, and said spatial frequency 1/L satisfy, for each lens surface, a following condition: 0<log .sigma.i<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}].

With respect to claim 92, the prior art dos not teach or disclose an optical scanner which performs optical scanning of a surface to be scanned by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, wherein when the optical spot to be formed on the surface to be scanned has an aimed spot diameter .omega. in a main scanning direction of the optical spot at an image height of 0, and a change .DELTA. in a beam waist position in the main scanning direction of the deflected luminous flux relative to the surface to be scanned is exploded into components of a spatial frequency, said change .DELTA.

satisfies a condition: {.DELTA..multidot..lambda./.omega..sup.2}<0.4 (20) within a range of spatial frequency (1/L: line/mm) of: 0.1<(1/L)<5.

With respect to claim 93, the prior art dos not teach or disclose 93. An optical scanner which performs optical scanning of a surface to be scanned by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, wherein said scanning image forming optical system comprises one or more lenses; and wherein when the optical spot to be formed on the surface to be scanned has an aimed spot diameter .omega. in a main scanning direction of the optical spot at an image height of 0, and a surface accuracy .sigma. on each lens of said scanning image forming optical system is exploded into components of a spatial frequency, within a range of the spatial frequency (1/L: line/mm) of: 0.1<(1/L)<5, a lens surface accuracy .sigma., a focal length f.sigma. in the main scanning direction at said surface accuracy .sigma., and a refractive index n of a lens having said lens surface satisfy a condition: 0<log .sigma.<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}] (21) within a range of luminous flux width equal to or greater than W in the main scanning direction on said lens surface, and satisfy a condition: 0<log .sigma.<-2 log(1/W)+log[1/{32 f.sigma.(n-1)}] (22) within a range of luminous flux width equal to or smaller than W.

With respect to claim 94, the prior art dos not teach or disclose an optical scanner which performs optical scanning of a surface to be scanned by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, wherein said scanning image forming optical system comprises one or more mirrors having an image forming function; and wherein when the optical spot to be formed on the surface to be scanned has a spot diameter .omega. in an aimed main scanning direction of the optical spot at an image height of 0, and the surface accuracy .sigma. of each mirror of said scanning image forming optical system is exploded into components of a spatial frequency within a range of the spatial frequency (1/L: line/mm) of: 0.1<(1/L)<5, a mirror surface accuracy .sigma., and a focal length f.sigma. in the main scanning direction at said surface accuracy .sigma. satisfy a condition: 0<log .sigma.<-2 log(1/L)+log[1/{64 f.sigma.}] (23) within a range of luminous flux width equal to or greater than W in the main scanning direction on said mirror surface, and satisfy a condition: 0<log .sigma.i<-2 log(1/W)+log[1/{64 f.sigma.}] (24) within a range of luminous flux equal to or smaller than

With respect to claim 95 and 98 the prior art dos not teach or disclose an image forming apparatus, comprising: a photosensitive medium for forming a latent image thereupon through optical scanning of a photosensitive surface thereof; a visualizing device configured to visualize the latent image on the photosensitive medium; and an

optical scanner configured to perform optical scanning of the photosensitive surface of the photosensitive medium to form the latent image by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, wherein when the optical spot to be formed on the surface to be scanned has an aimed spot diameter .omega. in a main scanning direction of the optical spot at an image height of 0, and a change .DELTA. in a beam waist position in the main scanning direction of the deflected luminous flux relative to the surface to be scanned is exploded into components of a spatial frequency, said change .DELTA. satisfies a condition: {.DELTA..multidot..lambda./.omega..sup.2}<0.4 (20) within a range of spatial frequency (1/L: line/mm) of: 0.1<(1/L)<5.

With respect to claim 96 and 99, the prior art dos not teach or disclose an image forming apparatus, comprising: a photosensitive medium for forming a latent image thereupon through optical scanning of a photosensitive surface thereof; a visualizing device configured to visualize the latent image on the photosensitive medium; and an optical scanner configured to perform optical scanning of the photosensitive surface of the photosensitive medium to form the latent image by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said surface to be scanned, wherein

said scanning image forming optical system comprises one or more lenses; and wherein when the optical spot to be formed on the surface to be scanned has an aimed spot diameter .omega. in a main scanning direction of the optical spot at an image height of 0, and a surface accuracy .sigma. on each lens of said scanning image forming optical system is exploded into components of a spatial frequency, within a range of the spatial frequency (1/L: line/mm) of: 0.2<(1/L)<5, a lens surface accuracy .sigma., a focal length f.sigma. in the main scanning direction at said surface accuracy .sigma., and a refractive index n of a lens having said lens surface satisfy a condition: 0<log .sigma.<-2 log(1/L)+log[1/{32 f.sigma.(n-1)}] (21) within a range of luminous flux width equal to or greater than W in the main scanning direction on said lens surface, and satisfy a condition: 0<log .sigma.<-2 log(1/W)+log[1/{32 f.sigma.(n-1)}] (22) within a range of luminous flux width equal to or smaller than W.

With respect to claim 97 and 100, the prior art dos not teach or disclose an image forming apparatus, comprising: a photosensitive medium for forming a latent image thereupon through optical scanning of a photosensitive surface thereof; a visualizing device configured to visualize the latent image on the photosensitive medium; and an optical scanner configured to perform optical scanning of the photosensitive surface of the photosensitive medium to form the latent image by deflecting a luminous flux having a wavelength .lambda. from a light source by means of an optical deflector, condensing the deflected luminous flux through a scanning image forming optical system toward the surface to be scanned to form an optical spot on said

surface to be scanned, wherein said scanning image forming optical system comprises one or more mirrors having an image forming function; and wherein when the optical spot to be formed on the surface to be scanned has a spot diameter .omega. in an aimed main scanning direction of the optical spot at an image height of 0, and the surface accuracy .sigma. of each mirror of said scanning image forming optical system is exploded into components of a spatial frequency within a range of the spatial frequency (1/L: line/mm) of: 0.1<(1/L)<5, a mirror surface accuracy .sigma., and a focal length f.sigma. in the main scanning direction at said surface accuracy .sigma. satisfy a condition: 0<log .sigma.<-2 log(1/L)+log[1/{64 f.sigma.}] (23) within a range of luminous flux width equal to or greater than W in the main scanning direction on said mirror surface, and satisfy a condition: 0<log .sigma.i<-2 log(1/W)+log[1/{64 f.sigma.}] (24) within a range of luminous flux equal to or smaller than W.

With respect to claim 101, the prior art dos not teach or disclose an optical scanning lens used in a scanning image forming optical system which condenses a luminous flux deflected by an optical deflector near a surface to be scanned, wherein, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..lambda..times.S'.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between a rear principal point and an image surface in the scanning image forming optical system.

With respect to claim 102, the prior art dos not teach or disclose an optical scanning lens used in a scanning image forming optical system which condenses a luminous flux deflected by an optical deflector near a surface to be scanned, wherein, when a maximum value of dispersion of curvature distribution of a curved surface in a main scanning direction within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..lambda..times.F.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and F: focal length of the scanning image forming optical system as a whole in the main scanning direction.

With respect to claim 103, the prior art dos not teach or disclose an optical scanning lens used in a scanning image forming optical system which condenses a luminous flux deflected by an optical deflector near a surface to be scanned, wherein, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: 0.2/K.ltoreq..DELTA.C.times.(n-1).times..lambda..times.(S'/w).sup.2.ltore- q.2 is satisfied, where: K: number of optical elements from the optical deflector to an image surface of the scanning image forming optical system; w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength;

and S': distance between the rear principal point and the image surface in the scanning image forming optical system.

With respect to claim 104, the prior art dos not teach or disclose an optical scanning lens used in a scanning image forming optical system which condenses a luminous flux deflected by an optical deflector near a surface to be scanned, wherein, when an average curvature of a curved surface within an area through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: q.sub.--PV.times.(n-1).times..lambda..times.(F/wd)- .sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned in the main scanning direction; n: refractive index of the lens; .lambda.: light source wavelength; F: focal length of the scanning image forming optical system in the main scanning direction; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}.

With respect to claim 105, the prior art dos not teach or disclose an optical scanning lens used in a scanning image forming optical system which condenses a luminous flux deflected by an optical deflector near a surface to be scanned, wherein, when an average curvature of a curved surface within an area of the lens through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: 0.1/K.ltoreq.q.sub.--PV.times.(n-1).times..lambda..times.(S'/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned; n: refractive index of the lens; .lambda.: light

source wavelength; S': distance between the rear principal point and the image surface of the scanning image forming optical system; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}.

With respect to claim 106, the prior art dos not teach or disclose an optical scanner comprising: a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..l-ambda..times.S'.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between a rear principal point and an image surface in the scanning image forming optical system

With respect to claim 107, the prior art dos not teach or disclose an optical scanner comprising: a light source; an optical deflector having a deflecting reflective

surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface in a main scanning direction within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..lambda..times.F.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and F: focal length of the scanning image forming optical system as a whole in the main scanning direction.

With respect to claim 108, the prior art dos not teach or disclose an optical scanner comprising: a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said

optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: 0.2/K.ltoreq..DELTA.C.times.(n-1).times..lambda-..times.(S'/w).sup.2.ltoreq.2 is satisfied, where: K: number of optical elements from the optical deflector to an image surface of the scanning image forming optical system; w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between the rear principal point and the image surface in the scanning image forming optical system.

With respect to claim 109, the prior art dos not teach or disclose an optical scanner comprising: a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when an average curvature of a curved surface within an area through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: q.sub.--PV.times.(n-1).times..la- mbda..times.(F/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned in the main scanning direction; n: refractive

index of the lens; .lambda.: light source wavelength; F: focal length of the scanning image forming optical system in the main scanning direction; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}.

With respect to claim 110, the prior art dos not teach or disclose an optical scanner comprising: a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when an average curvature of a curved surface within an area of the lens through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: 0.1/K.ltoreq.q.sub.--PV.times.(n-1).times..lambda..times.(S'/wd).sup.2.lt- oreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; S': distance between the rear principal point and the image surface of the scanning image forming optical system; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}.

With respect to claim 111, the prior art dos not teach or disclose an image forming apparatus comprising: a photosensitive member; and an optical scanner including, a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans the surface to be scanned at a uniform speed by means of said optical spot, wherein, in said optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..lambda..times-.S'.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between a rear principal point and an image surface in the scanning image forming optical system, and wherein the surface to be scanned comprises the photosensitive member, and an electrostatic latent image is formed on the surface to be scanned through optical scanning of the surface to be scanned by said optical scanner.

With respect to claim 112, the prior art dos not teach or disclose 112. An image forming apparatus comprising: a photosensitive member; and an optical scanner including, a light source; an optical deflector having a deflecting reflective surface and

configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans a surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface in a main scanning direction within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.-2/{(n-1).times..lambda..times.F.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and F: focal length of the scanning image forming optical system as a whole in the main scanning direction, and wherein the surface to be scanned comprises the photosensitive member, and an electrostatic latent image is formed on the surface to be scanned through optical scanning of the surface to be scanned by said optical scanner.

With respect to claim 113, the prior art dos not teach or disclose an image forming apparatus comprising: a photosensitive member; and an optical scanner including, a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans a surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: 0.2/K.ltoreq..DELTA.C.times.(n-1).times..lambda..times.(S'/- w).sup.2.ltoreq.2 is satisfied, where: K: number of optical elements from the optical deflector to an image surface of the scanning image forming optical system; w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between the rear principal point and the image surface in the scanning image forming optical system, and wherein the surface to be scanned comprises the photosensitive member, and an electrostatic latent image is formed on the surface to be scanned through optical scanning of the surface to be scanned by said optical scanner.

With respect to claim 114, the prior art dos not teach or disclose an image forming apparatus comprising: a photosensitive member; and an optical scanner

including, a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans a surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when an average curvature of a curved surface within an area through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: q.sub.--PV.times.(n-1).times..la- mbda..times.(F/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned in the main scanning direction; n: refractive index of the lens; .lambda.: light source wavelength; F: focal length of the scanning image forming optical system in the main scanning direction; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}, and, wherein the surface to be scanned comprises the photosensitive member, and an electrostatic latent image is formed on the surface to be scanned through optical scanning of the surface to be scanned by said optical scanner.

With respect to claim 115, the prior art dos not teach or disclose an image forming apparatus comprising: a photosensitive member; and an optical scanner including, a light source; an optical deflector having a deflecting reflective surface and configured to deflect a luminous flux from the light source; and a scanning image

forming optical system including an optical scanning lens, wherein the optical scanner deflects the luminous flux from the light source at an equiangular speed with the optical deflector, condenses the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scans a surface to be scanned at a uniform speed by means of said optical spot, and wherein, in said optical scanning lens, when an average curvature of a curved surface within an area of the lens through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: 0.1/K.ltoreq.q.sub.--PV.ti- mes.(n-1).times..lambda..times.(S'/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; S': distance between the rear principal point and the image surface of the scanning image forming optical system; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}, and wherein the surface to be scanned comprises the photosensitive member, and an electrostatic latent image is formed on the surface to be scanned through optical scanning of the surface to be scanned by said optical scanner.

With respect to claim 116, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system including an optical scanning lens, in which when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.- 2/{(n-1).times..lambda..times.S'.sup.2} is satisfied,

where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between a rear principal point and an image surface in the scanning image forming optical system; and causing an optical deflector to deflect a luminous flux from a light source at an equiangular speed, condensing the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scanning the surface to be scanned at a uniform speed by means of said optical spot.

With respect to claim 117, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system including an optical scanning lens, in which when a maximum value of dispersion of curvature distribution of a curved surface in a main scanning direction within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: .DELTA.C.ltoreq.2.times.w.sup.2/{(n-1).times..lambda..times.F.sup.2} is satisfied, where: w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and F: focal length of the scanning image forming optical system as a whole in the main scanning direction; and causing an optical deflector to deflect a luminous flux from a light source at an equiangular speed, condensing the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scanning the surface to be scanned at a uniform speed by means of said optical spot.

With respect to claim 118, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system including an optical scanning lens, in which when a maximum value of dispersion of curvature distribution of a curved surface within an area of the lens through which passes the luminous flux is .DELTA.C, a relationship: 0.2/K.ltoreq..DELTA.C.times.(n- -1).times..lambda..times.(S'/w).sup.2.ltoreq.2 is satisfied, where: K: number of optical elements from the optical deflector to an image surface of the scanning image forming optical system; w: beam spot radius on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; and S': distance between the rear principal point and the image surface in the scanning image forming optical system; and causing an optical deflector to deflect a luminous flux from a light source at an equiangular speed, condensing the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scanning the surface to be scanned at a uniform speed by means of said optical spot.

With respect to claim 119, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system including an optical scanning lens, in which when an average curvature of a curved surface within an area through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: q.sub.--PV.times.(n-1).times..lambda..times.(F/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam

spot diameter on the surface to be scanned in the main scanning direction; n: refractive index of the lens; .lambda.: light source wavelength; F: focal length of the scanning image forming optical system in the main scanning direction; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}; and causing an optical deflector to deflect a luminous flux from a light source at an equiangular speed, condensing the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scanning the surface to be scanned at a uniform speed by means of said optical spot.

With respect to claim 120, the prior art dos not teach or disclose an optical scanning method, comprising the steps of: providing a scanning image forming optical system including an optical scanning lens, in which when an average curvature of a curved surface within an area of the lens through which passes the luminous flux is q(x), and an approximate curve of a tenth or lower degree of q(x) is q0(x), a relationship: 0.1/K.ltoreq.q.sub.--PV.times.(n-1).times..lambda..times.(S- '/wd).sup.2.ltoreq.1 is satisfied, where: wd: beam spot diameter on the surface to be scanned; n: refractive index of the lens; .lambda.: light source wavelength; S': distance between the rear principal point and the image surface of the scanning image forming optical system; and q_PV=max{q(x)-q0(x)}-min{q(x)-q0(x)}; and causing an optical deflector to deflect a luminous flux from a light source at an equiangular speed, condensing the deflected luminous flux onto a surface to be scanned as an optical spot through the optical scanning lens, and scanning the surface to be scanned at a uniform speed by means of said optical spot.

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Negussie Worku whose telephone number is 305-5441. The examiner can normally be reached on 7am-4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kimberly Williams can be reached on 703-305-4863. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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